

FIG. 1

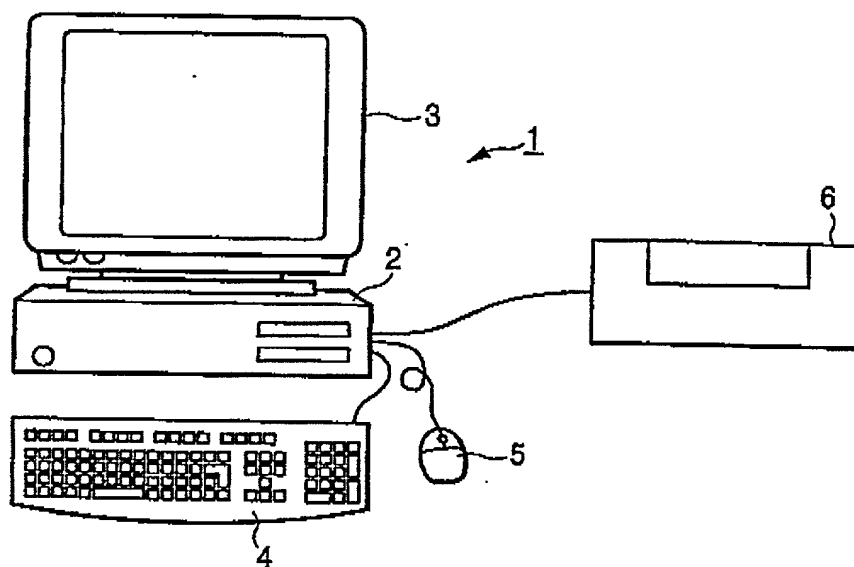


FIG. 2

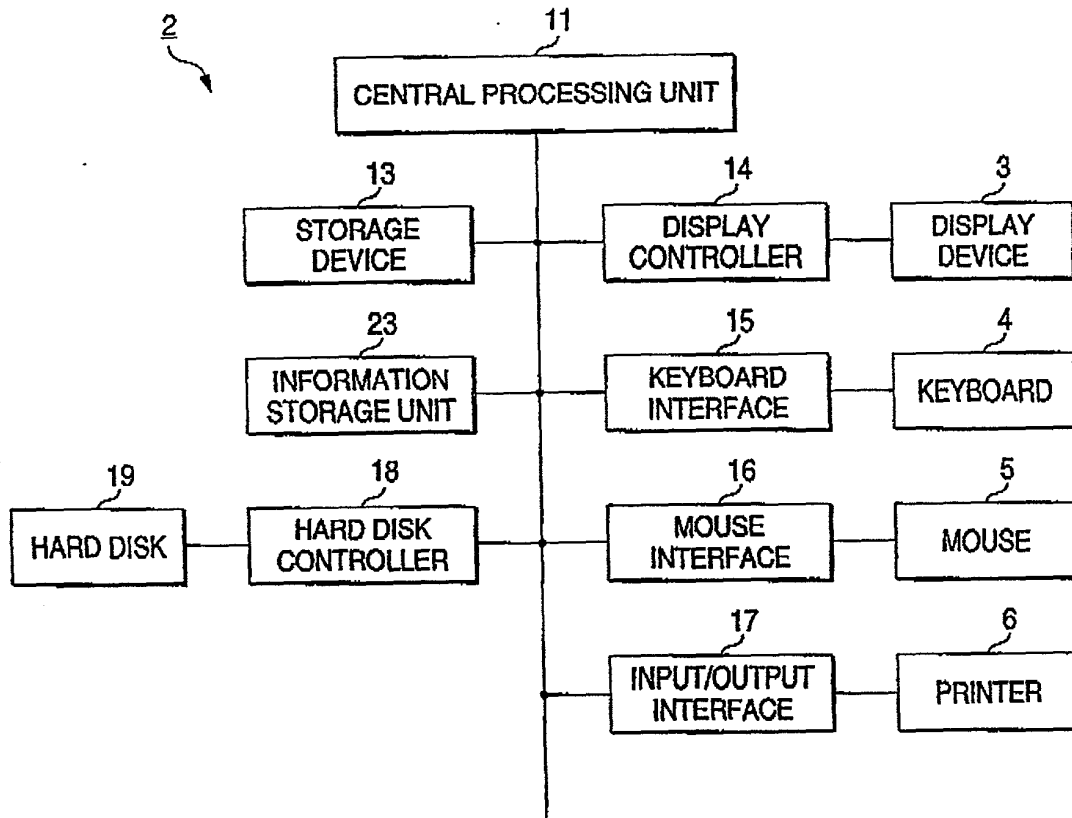
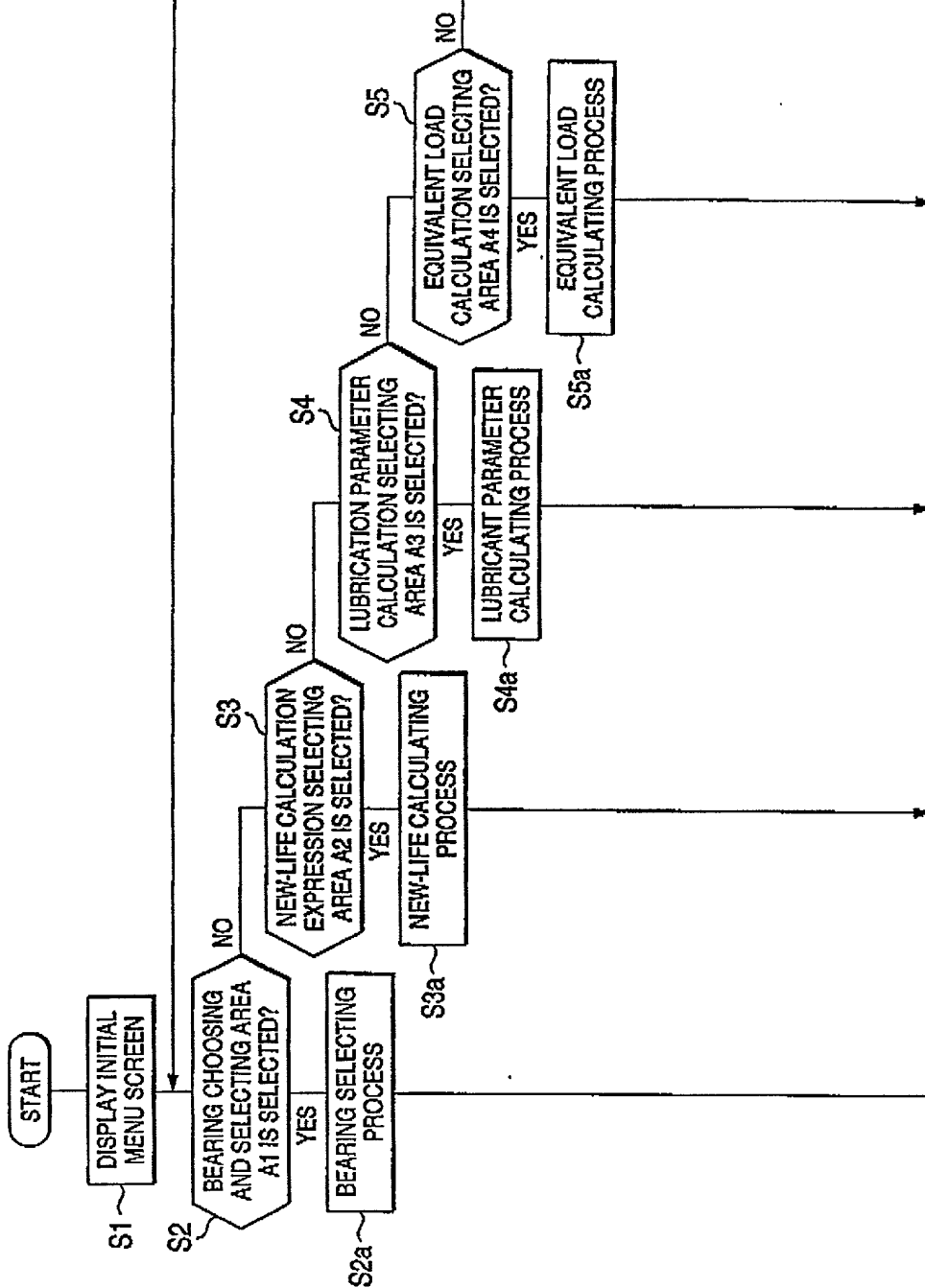


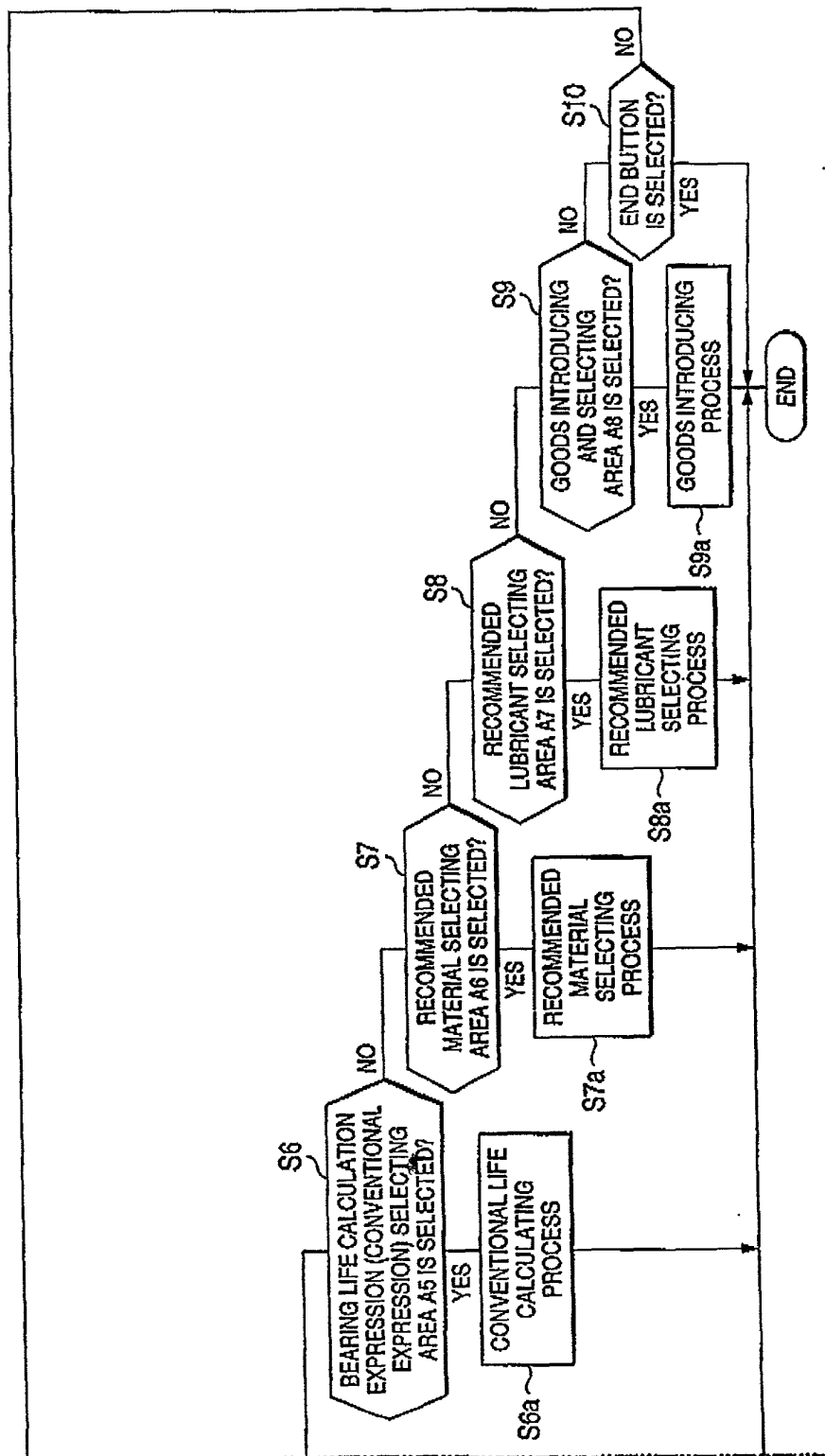
FIG. 3



(CONT.)

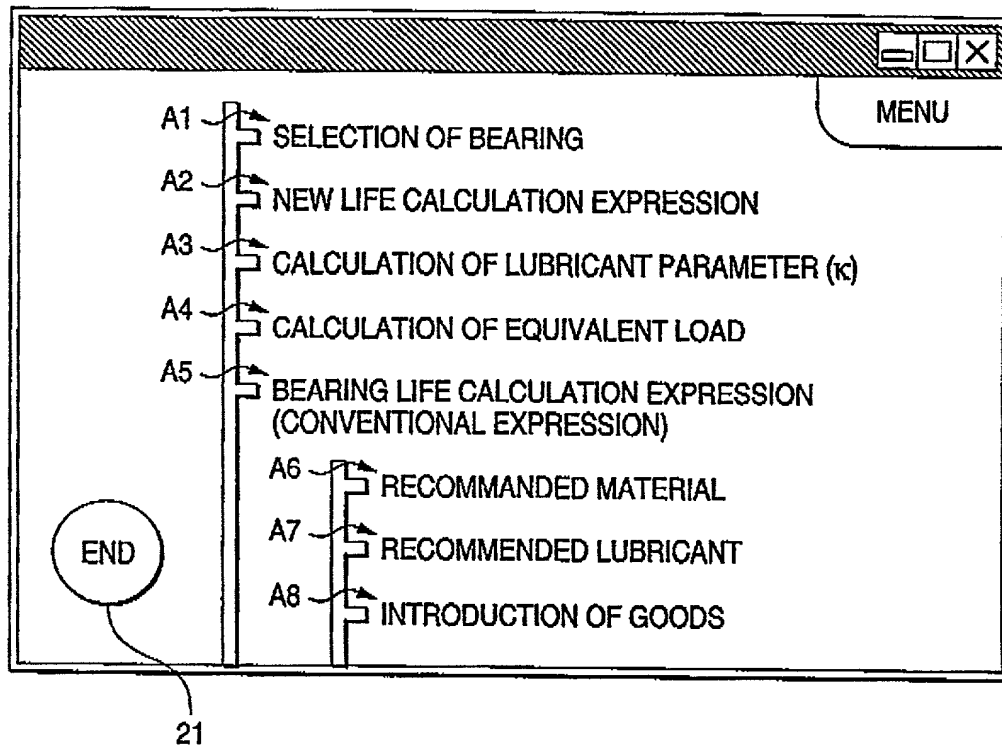
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(FIG. 3 CONTINUED)



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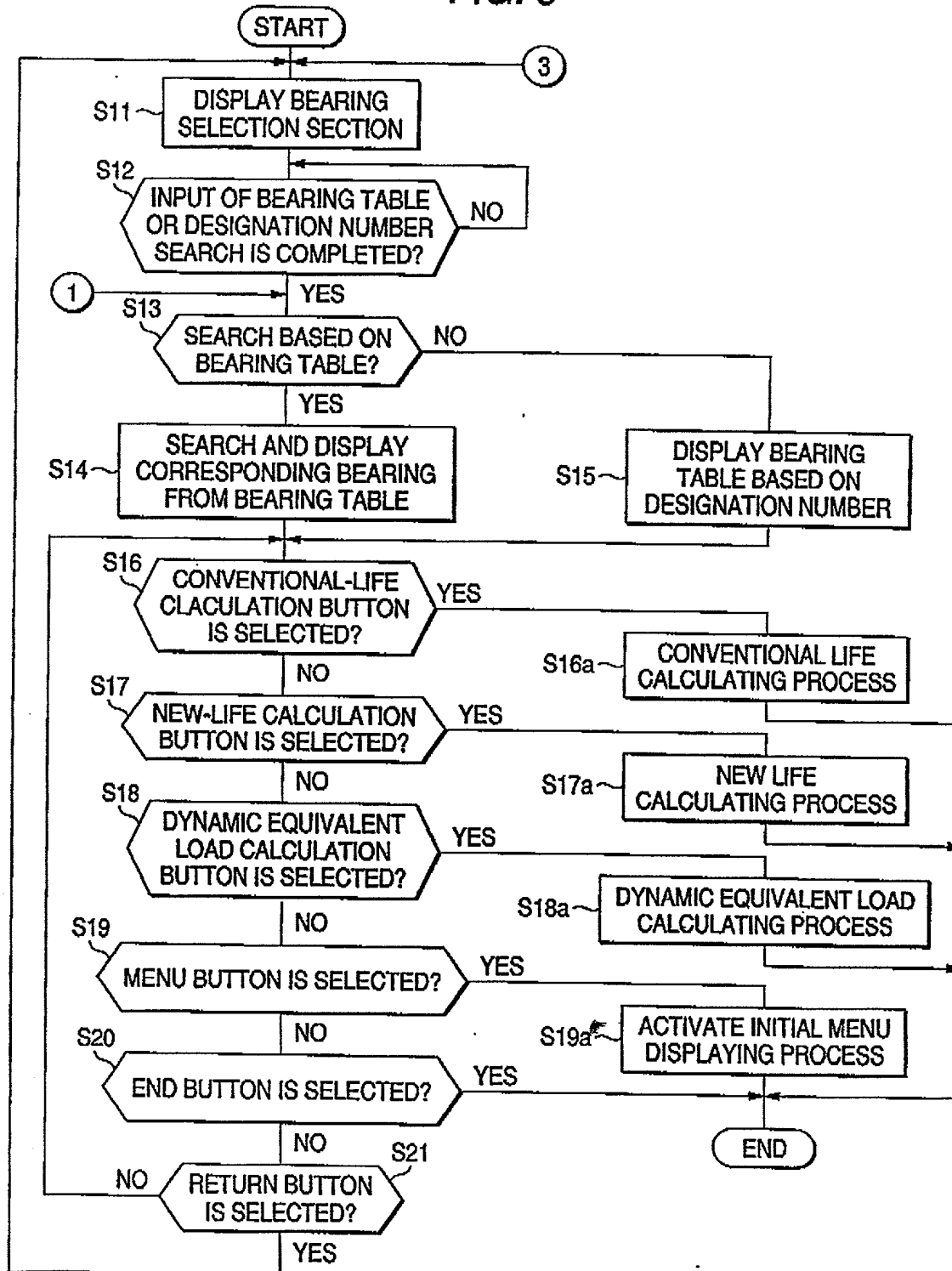
FIG. 4



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FIG. 5



004051-02001

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FIG. 6

SELECTION OF BEARING

SEARCH FROM BEARING TABLE

INNER DIAMETER d (mm)		OUTER DIAMETER D (mm)	WIDTH (HEIGHT) B (T) (mm)
MINIMUM:	<input type="text"/>	<input type="text"/>	<input type="text"/>
MAXIMUM:	<input type="text"/>	<input type="text"/>	<input type="text"/>

DEEP GROOVE BALL BEARING	CYLINDRICAL ROLLER BEARING
ANGULAR BALL BEARING	TAPERED ROLLER BEARING
SELF-ALIGNING BALL BEARING	SELF-ALIGNING ROLLER BEARING
SINGLE-DIRECTION THRUST BALL BEARING	THRUST BEARING

SEARCH BASED ON DESIGNATION NUMBER

REFERENCE

MENU

END

FIG. 7

DEEP GROOVE BALL BEARING

DESIGNATION NUMBER	PRINCIPAL DIMENSION (mm)			BASIC LOCAL RATING (N)		FACTOR	ALLOWABLE ROTATION NUMBER (MIN ⁻¹)		
	d	D	B	r	Cr		Grease	Oil	
6800	10	19	5	0.3	1720	840	14.8	34000	400
6800DD	10	19	5	0.3	1720	840	14.8	24000	
6900VV	10	19	5	0.3	1720	840	14.8	34000	
6800ZZ	10	19	5	0.3	1720	840	14.8	34000	
6900	10	22	6	0.3	2700	1270	14	32000	380
6900DD	10	22	6	0.3	2700	1270	14	22000	
6900N	10	22	6	0.3	2700	1270	14	32000	380
6900NR	10	22	6	0.3	2700	1270	14	32000	380
6900VV	10	22	6	0.3	2700	1270	14	32000	
6900ZZ	10	22	6	0.3	2700	1270	14	32000	
6000	10	26	8	0.3	4550	1970	12.4	30000	360
6000DDU	10	26	8	0.3	4550	1970	12.4	22000	

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BEARING TABLE

DEEP GROOVE BALL BEARING

DISPLAY AS
DIAGRAM

CONVENTIONAL
LIFE CALCULATION

NEW LIFE
CALCULATION

DYNAMIC EQUIVALENT
LOAD CALCULATION

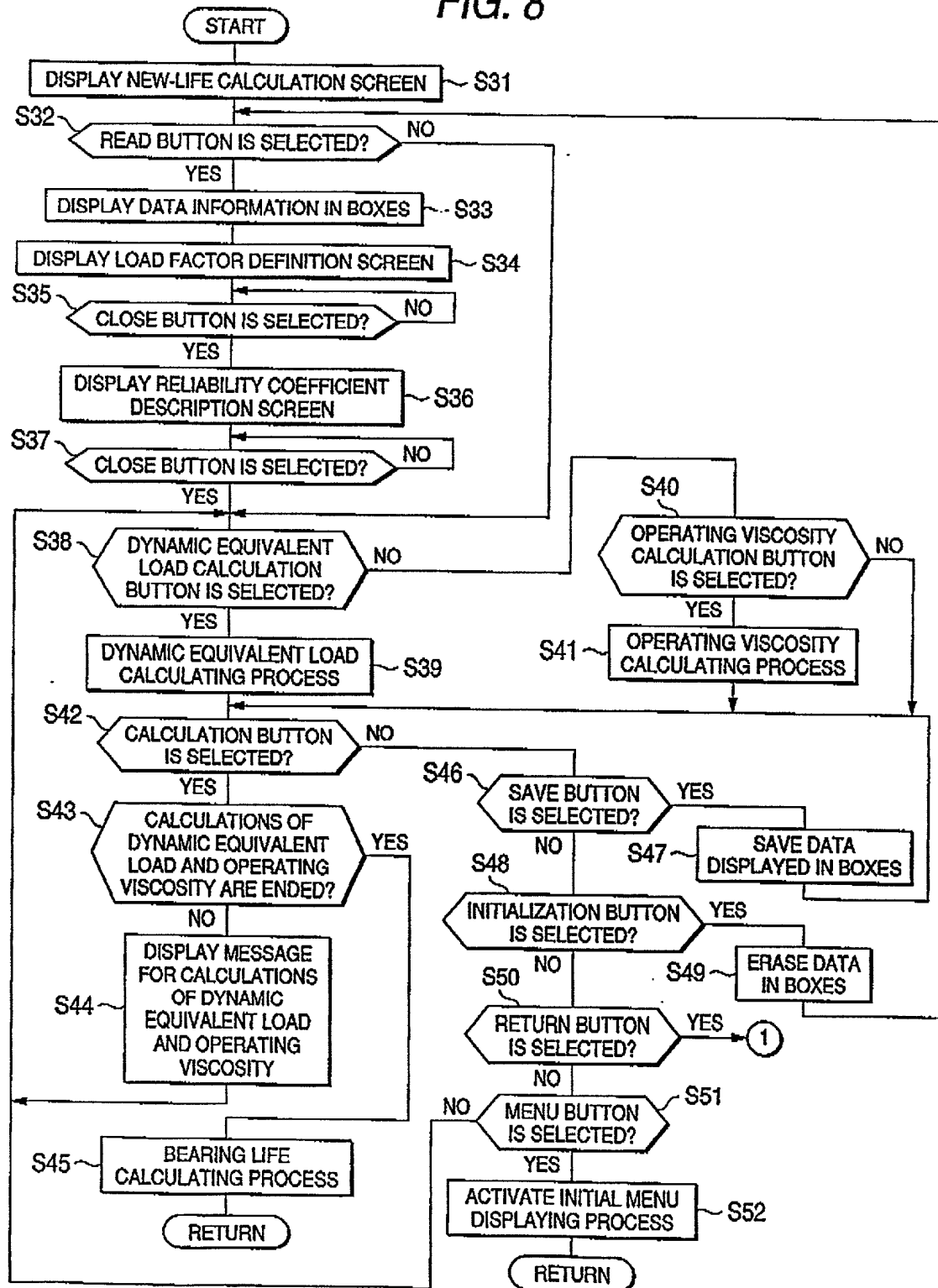
RETURN

MENU

END

32 33 34 35 36 37

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FIG. 8



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FIG. 9

The interface is titled "NEW LIFE CALCULATION EXPRESSION" and includes a "HELP" button in the top right corner. The main area is divided into several sections for inputting data:

- BEARING TYPE:** A dropdown menu showing "DEEP GROOVE BALL BEARING".
- BEARING DYNAMIC LOAD RATING C (N):** An input field with a value of 53.
- BEARING INNER DIAMETER (mm):** An input field with a value of 55.
- BEARING DYNAMIC EQUIVALENT LOAD (N):** An input field with a value of 57.
- CALCULATION OF DYNAMIC EQUIVALENT LOAD:** A button labeled 60.
- ROTATION NUMBER (min⁻¹):** An input field with a value of 61.
- CONTAMINATION DEGREE COEFFICIENT a_c:** A dropdown menu showing "ORDINARY (a_c = 0.5)".
- CALCULATION:** A button labeled 42.
- READ:** A button labeled 43.
- SAVE:** A button labeled 44.
- INITIALIZATION:** A button labeled 45.
- RETURN:** A button labeled 46.
- WENU:** A button labeled 47.

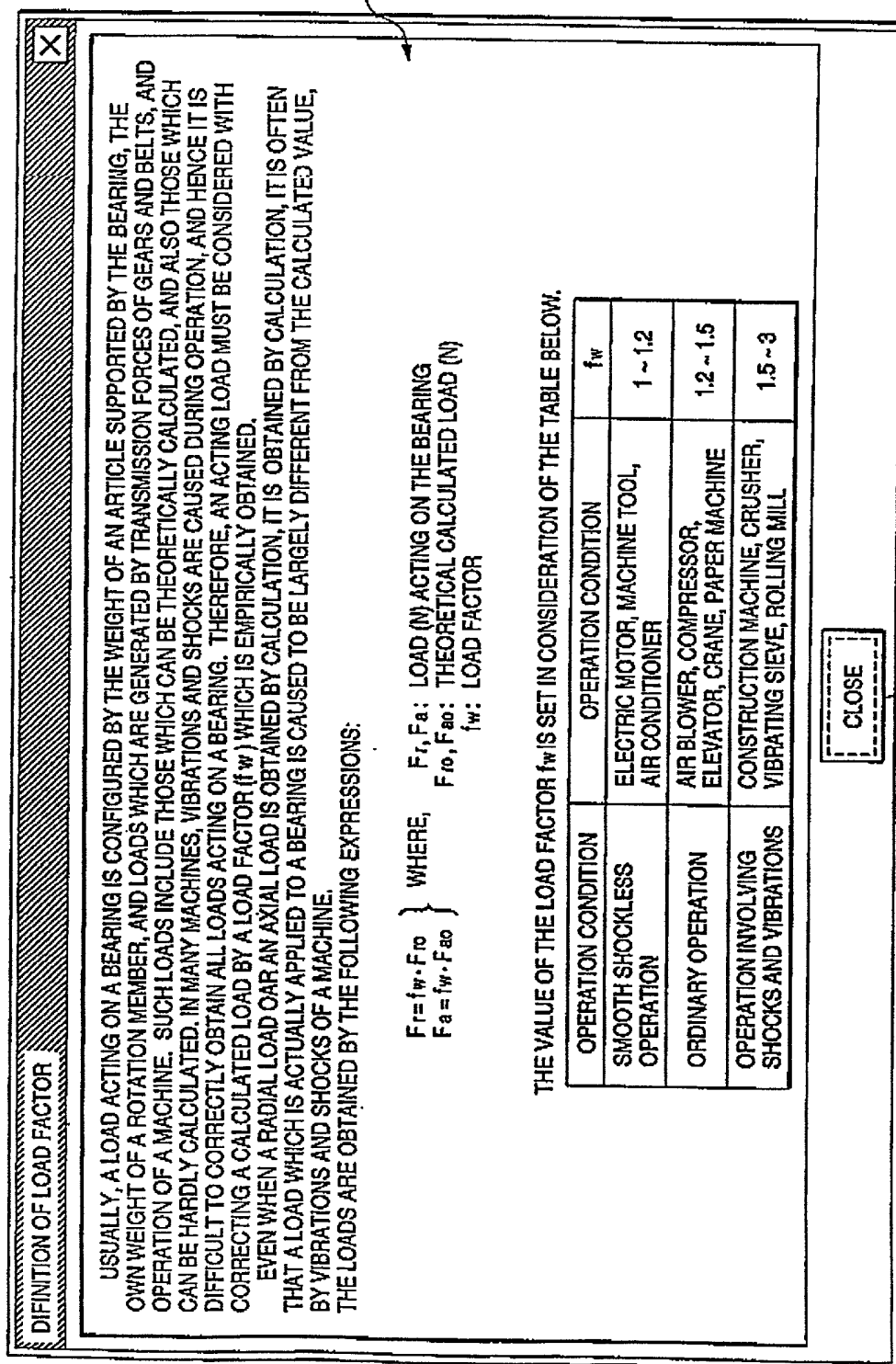
On the right side, there are additional input fields and buttons:

- DESIGNATION NUMBER:** An input field with a value of 52.
- BEARING STATIC LOAD RATING C₀ (N):** An input field with a value of 54.
- FATIGUE LIMIT LOAD P₀ (N):** An input field with a value of 56.
- SPECIAL INPUT: ○ NECESSARY ● UNNECESSARY:** Radio buttons for selecting the input type.
- LOAD FACTOR f_w:** An input field with a value of 58.
- RELIABILITY (%) a₁:** A dropdown menu showing 90.
- OPERATING VISCOSITY v (mm²/s):** An input field with a value of 63.
- CALCULATION OF OPERATING VISCOSITY (v):** A button labeled 64.
- SPECIFICATION OF BEARING MATERIAL:** A dropdown menu showing "HIGH-CARBON CHROME BEARING STEEL (SUJ2, SUJ32)".
- CALCULATION OF OPERATING VISCOSITY (v):** A button labeled 67.

At the bottom left, there is a status bar showing "LA = 818mskL10".

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FIG. 10



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FIG. 11

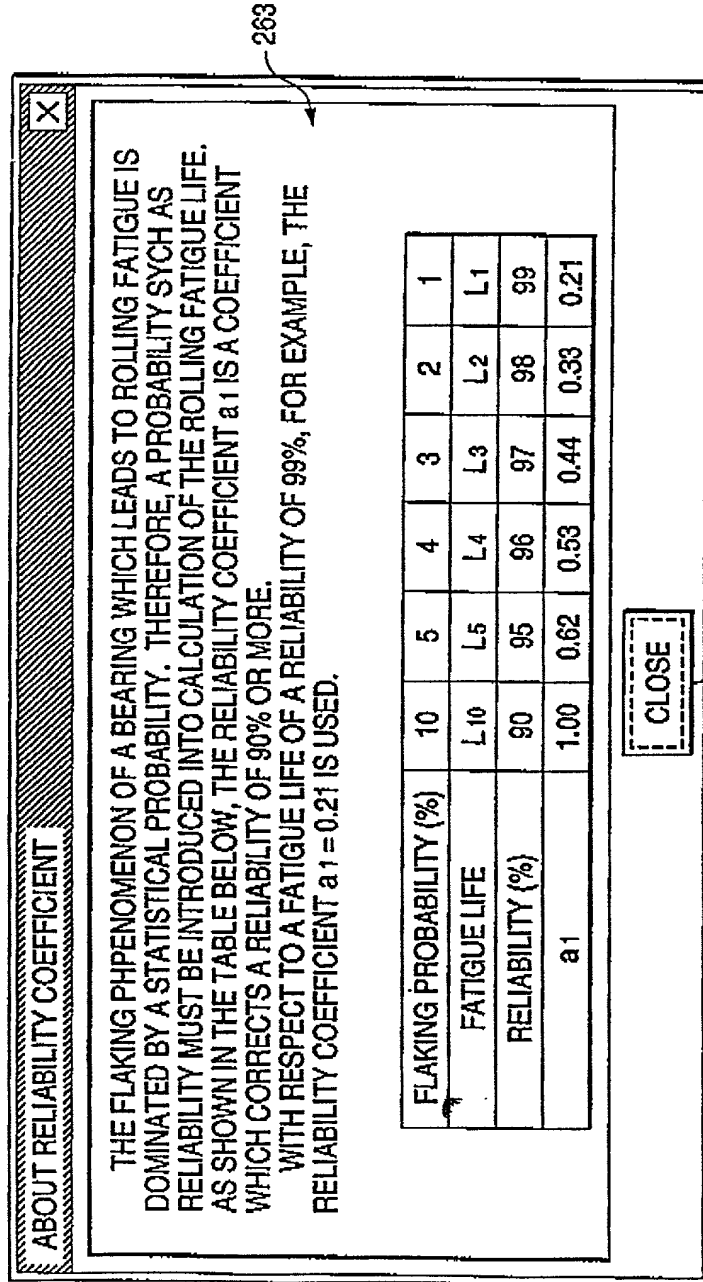


FIG. 12

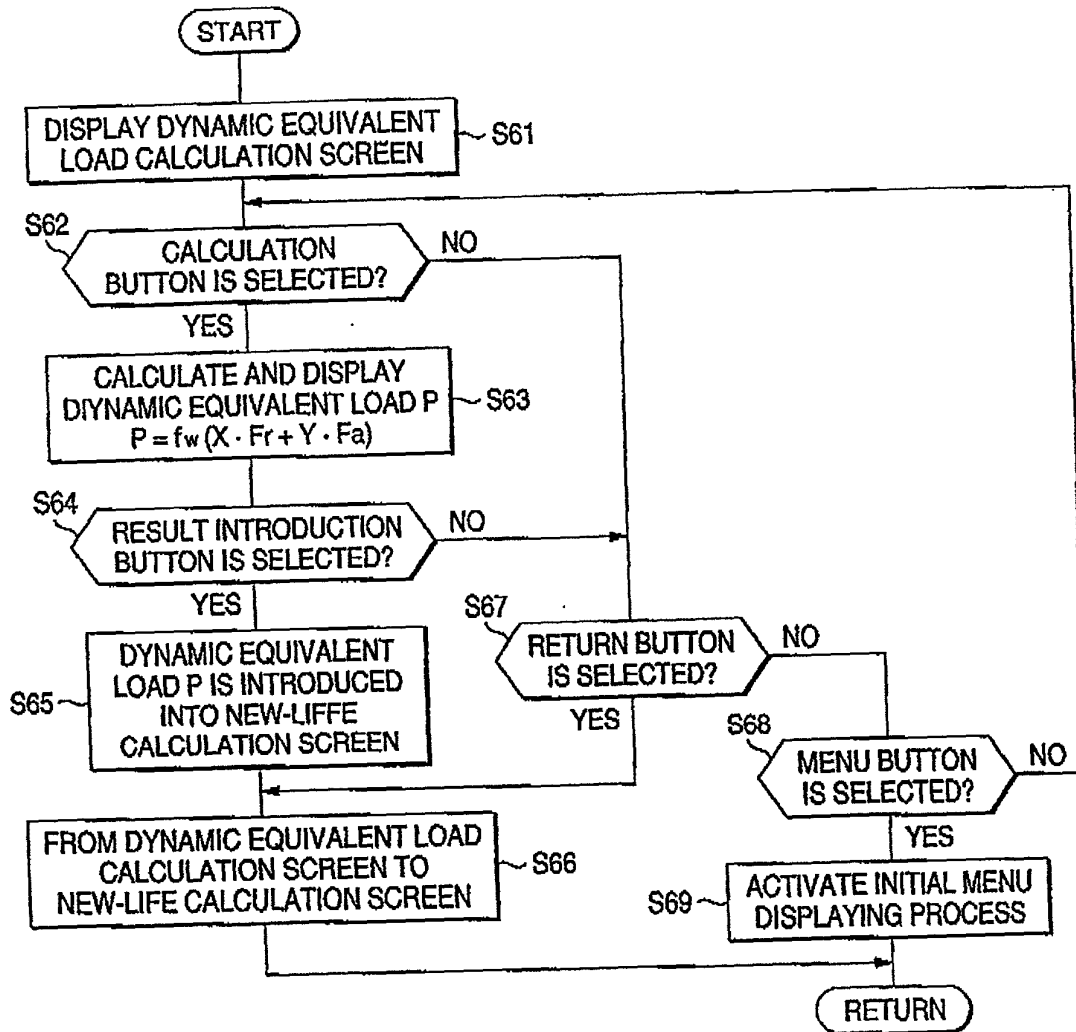


FIG. 13

CALCULATION OF DYNAMIC EQUIVALENT LOAD

BEARING TYPE: DEEP GROOVE BALL BEARING

DESIGNATION NUMBER: 6206

SERVICE CONDITION	RADIAL LOAD (N)	AXIAL LOAD (N)	ROTATION NUMBER (min^{-1})	SERVICE CONDITION RATIO (%)
1				
2				
3				

ADDITIONAL INPUT

DYNAMIC EQUIVALENT LOAD P (N): P

AVERAGE ROTATION NUMBER (min^{-1}): N

CALCULATION

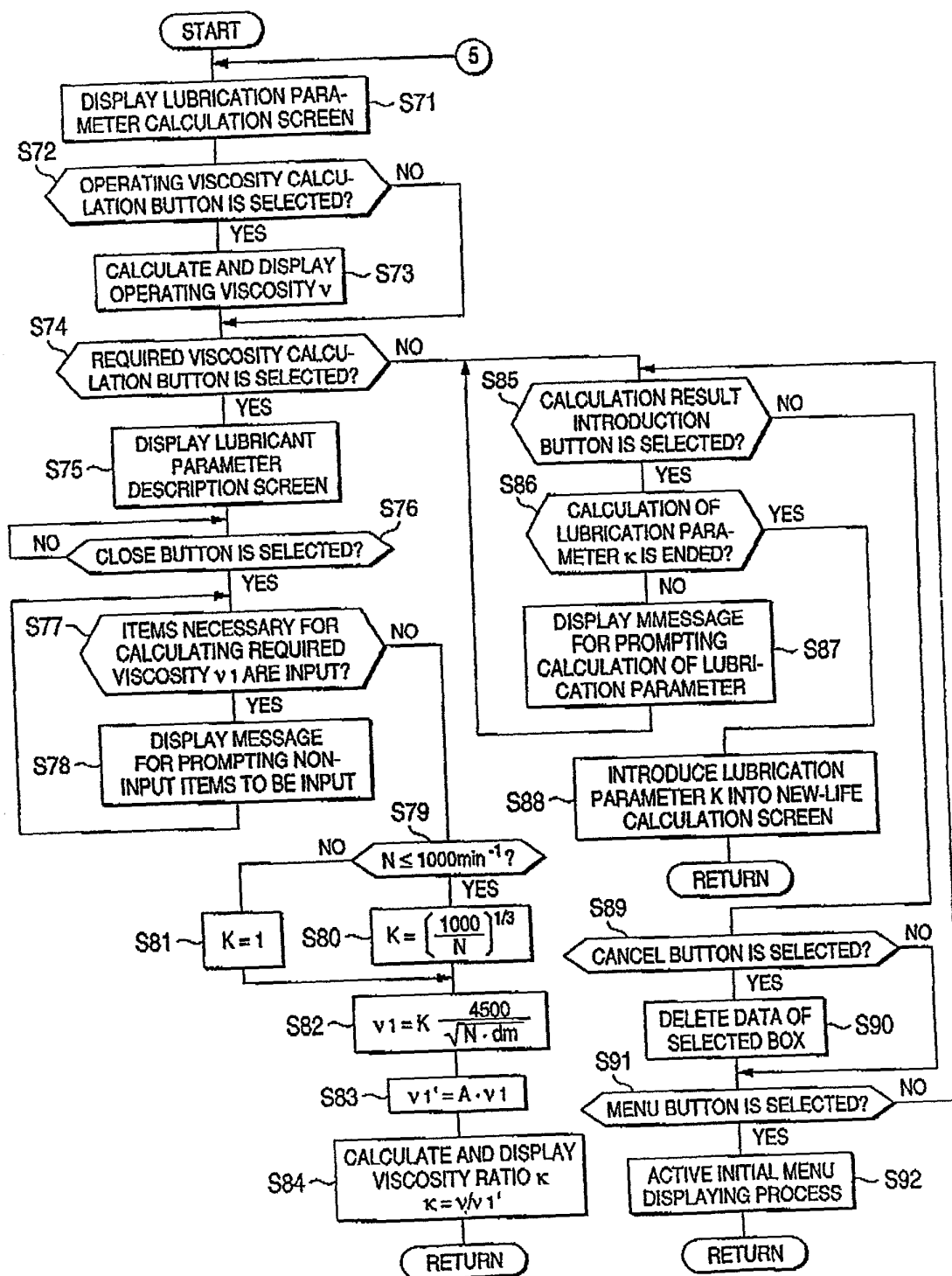
RESULT INTRODUCTION

RETURN

MENU

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FIG. 14



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FIG. 15

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94

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REQUIRED VISCOSITY v^1

PITCH CIRCLE DIAMETER d_m (mm)

46

BEARING ROTATION NUMBER (min^{-1})

N

REQUIRED VISCOSITY v^1 (mm^2/s)

CORRECTED REQUIRED VISCOSITY v^1'

$v^1' = A \times v^1$

BEARING PERFORMANCE COEFFICIENT A

REQUIRED VISCOSITY v^1 (mm^2/s)

286

285

CANCEL

284

INTRODUCTION OF CALCULATION RESULT

283

CALCULATION OF REQUIRED VISCOSITY

282

CALCULATION OF OPERATING VISCOSITY

92

87

88

90

89

91

OPERATING VISCOSITY v

(1) BRAND OF LUBRICANT IS KNOWN

LUBRICANT

VISCOSITY OF LUBRICATING OIL AT 40°C

88

89

OPERATING TEMPERATURE (°C)

90

OPERATING VISCOSITY n (mm^2/s)

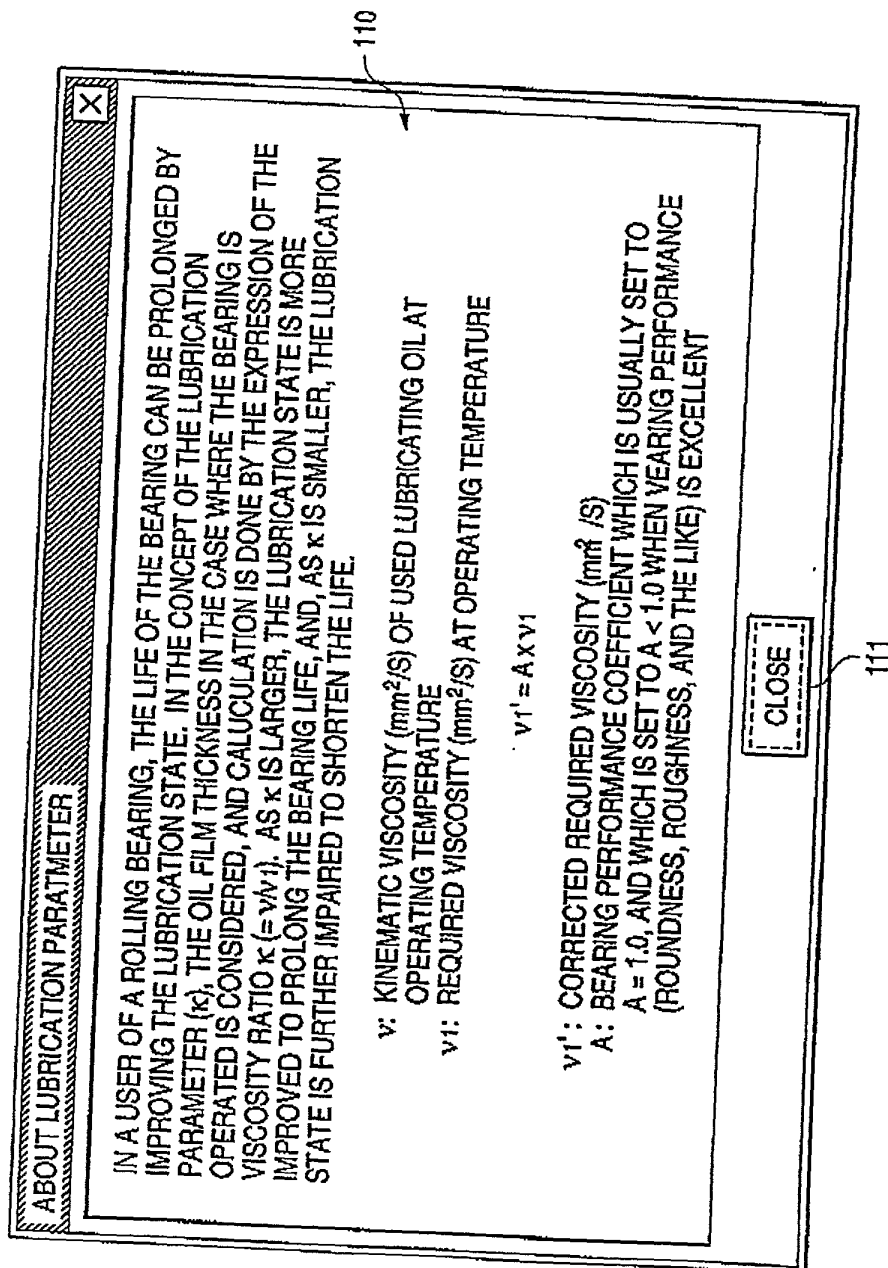
91

LUBRICATION PARAMETER κ

$\kappa = v/v^1 =$

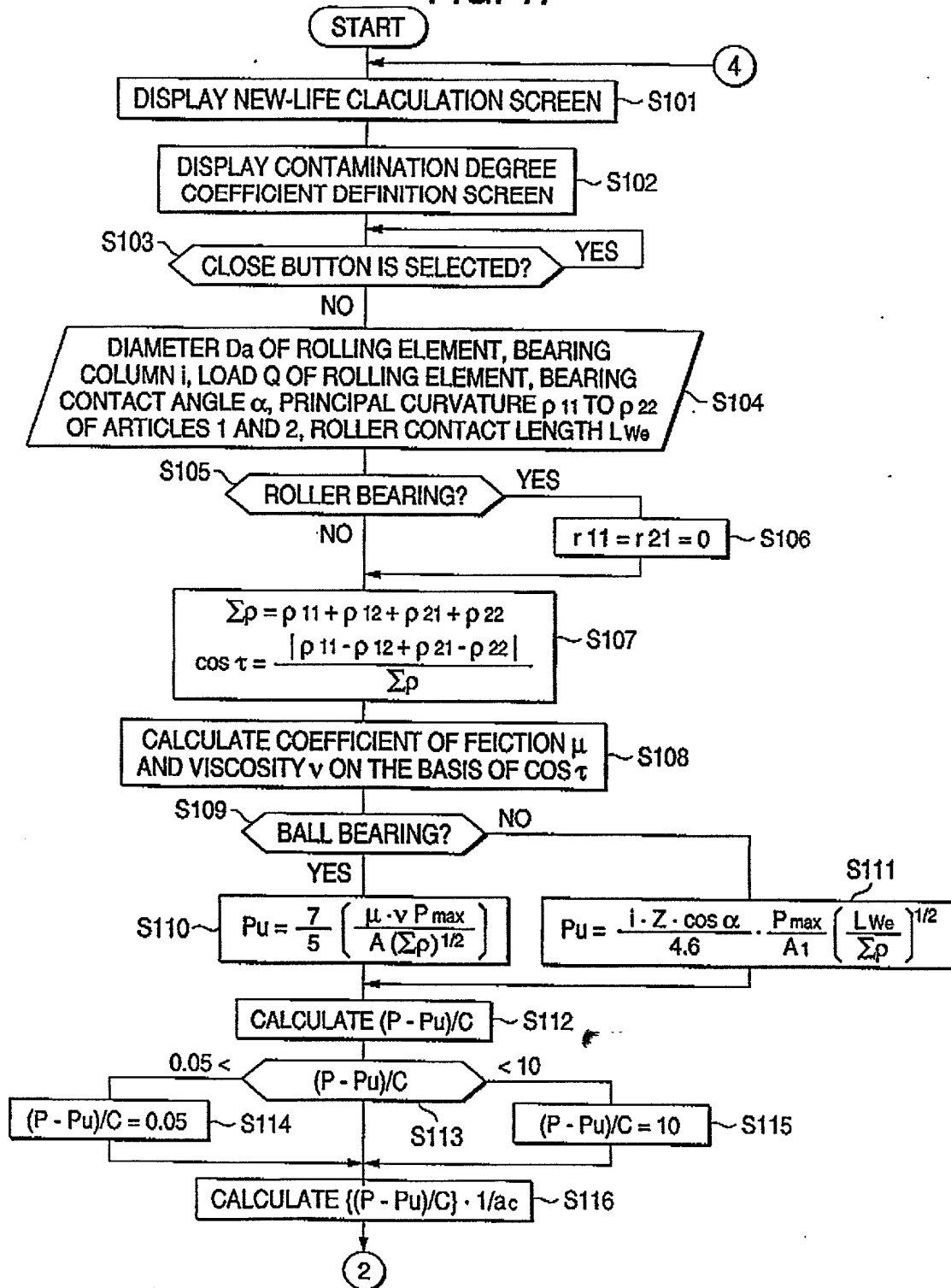
98

FIG. 16



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FIG. 17



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FIG. 18

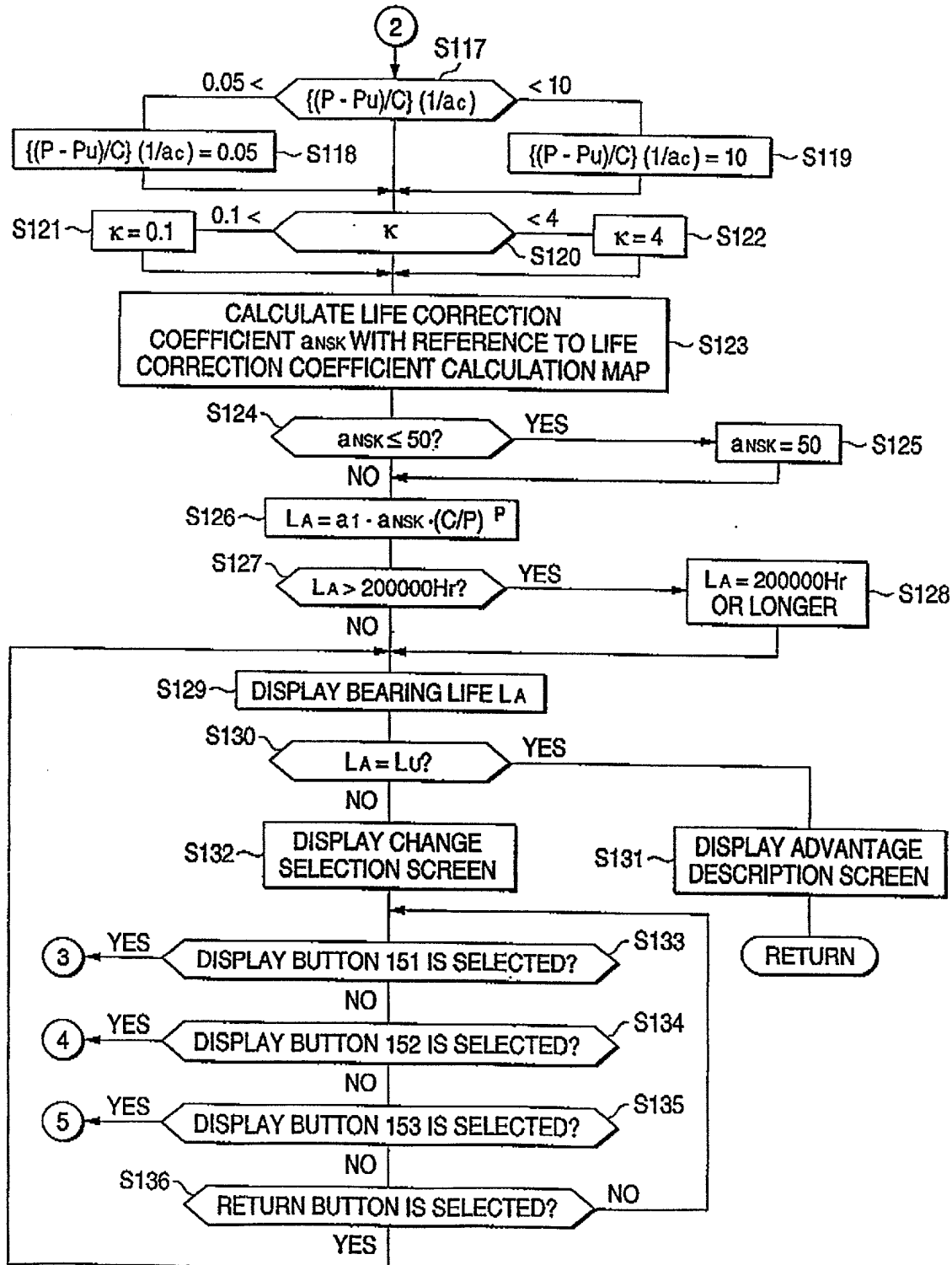


FIG. 19

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DEFINITION OF CONTAMINATION DEGREE COEFFICIENT

WHEN A FOREIGN MATTER ENTERS A BEARING DURING OPERATION, AN IMPRESSION IS FORMED IN THE ROLLING FACE, AND STRESS CONCENTRATION IN AN IMPRESSED PORTION CAUSES FLAKING. IN THE NEW LIFE CALCULATION EXPRESSION, THE ENVIRONMENT STATE IS CLASSIFIED INTO FIVE STAGES OF APPLICATION EXAMPLES, AND THE CONTAMINATION DEGREE COEFFICIENT (ac) IS DEFINED AS IN THE TABLE BELOW.

	VERY CLEAN	CLEAN	ORDINARY	CONTAMINATED	HEAVILY CONTAMINATED
ac	1	0.8	0.5	0.4 - 0.1	0.05
INDEX OF APPLICATION	FILTER MANAGEMENT OF 10 μ m OR SMALLER	FILTER MANAGEMENT OF 10 - 30 μ m	FILTER MANAGEMENT OF 30 - 100 μ m	FILTER LARGER THAN 100 μ m OR WITHOUT FILTER MANAGEMENT (DIP-FEED, CIRCULATING OIL FEED, ETC.)	WITHOUT FILTER, CONTAMINATED WITH LARGE AMOUNT OF DUST
EXAMPLE OF APPLICATION	<ul style="list-style-type: none"> SEALED GREASED BEARING FOR ELECTRICAL APPLIANCE, INFORMATION, ETC. 	<ul style="list-style-type: none"> SEALED GREASED BEARING FOR MOTOR SEALED GREASED BEARING FOR RAILCAR SEALED GREASED BEARING FOR MACHINE TOOL, ETC. 	<ul style="list-style-type: none"> ORDINARY USE OPEN TYPE GREASED BEARING, ETC. 	<ul style="list-style-type: none"> FOR TRANSMISSION OF AUTOMOBILE FOR HUB OF AUTOMOBILE FOR REDUCTION GEAR FOR CONSTRUCTION MACHINERY, ETC. 	

CLOSE

WHEN A FOREIGN MATTER ENTERS A BEARING DURING OPERATION, AN IMPRESSION IS FORMED IN THE ROLLING FACE, AND STRESS CONCENTRATION IN AN IMPRESSED PORTION CAUSES FLAKING. IN THE NEW LIFE CALCULATION EXPRESSION, THE ENVIRONMENT STATE IS CLASSIFIED INTO FIVE STAGES OF APPLICATION EXAMPLES, AND THE CONTAMINATION DEGREE COEFFICIENT (ac) IS DEFINED AS IN THE TABLE BELOW.

CLOSE

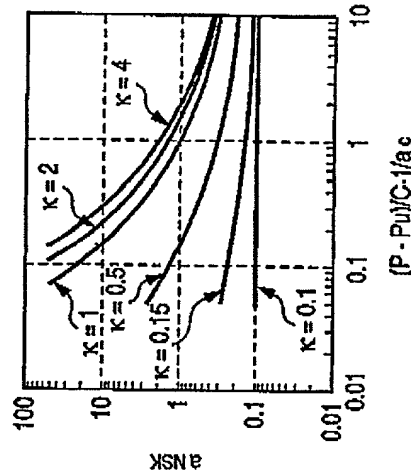
FIG. 20

ABOUT LIFE CORRECTION COEFFICIENT ACCORDING TO NEW LIFE THEORY

THE NEW LIFE CALCULATION EXPRESSION HAS BEEN DEVELOPED BY US ON THE BASIS OF EXPERIMENTAL DATA UNDER VARIOUS ENVIRONMENTS AND THEORETICAL ANALYSIS PERFORMED. A LIFE CALCULATION THEORY IS ESTABLISHED BY COLLATION WITH PLENTIFUL DATA RECOVERED FROM THE MARKET. IN THE NEW THEORY, THE CONCEPT OF THE FATIGUE LIMIT WHICH IS OBSERVED IN A FATIGUE PHENOMENON OF A MATERIAL IS INTRODUCED ALSO INTO THE ROLLING FATIGUE, AND THE FATIGUE LIMIT LOAD P_u (AN EQUIVALENT LOAD AT THE MAXIMUM CONTACT SURFACE PRESSURE $P_{max} = 1.5 \text{ GPa}$ UNDER A CLEAN AND IDEAL STATE) WHICH IS SUPPORTED BY EXPERIMENTAL DATA IS USED. BY CONTRAST, WHEN INFLUENCE DUE TO AN EDGE LOAD OR SLIPPAGE, OR THE LIKE IS OBSERVED, THE FATIGUE LIMIT LOAD IS CORRECTED. FURTHERMORE, THE CONTAMINATION DEGREE COEFFICIENT (a_c) AND THE LUBRICATION PARAMETER (κ) WHICH ARE INDEXES INDICATING THE SERVICE ENVIRONMENT ARE INTRODUCED WITH NUMERICAL MANNER.

AS A RESULT, WHEN THE SERVICE ENVIRONMENT IS INPUT, IT IS POSSIBLE TO QUANTITATIVELY ESTIMATE THE DEGREE OF INFLUENCE ON THE BEARING FATIGUE LIFE. THE CORRECTION COEFFICIENT (a_{nsk}) IN THE NEW LIFE CALCULATION EXPRESSION IS DEFINED AS A FUNCTION OF THE LUBRICATION PARAMETER κ (VISCOSITY RATIO) WITH SETTING A LOAD PARAMETER $\{(P - P_u)/C\} \cdot 1/a_c$ AS THE ABSCISSA.

AN EXAMPLE (BALL BEARING) OF A GRAPH FOR OBTAINING THE LIFE CORRECTION COEFFICIENT IS SHOWN IN THE RIGHT FIGURE.



CLOSE

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FIG. 21

OUTPUT OF RESULT

BEARING TYPE: DEEP GROOVE BALL BEARING

BEARING DYNAMIC LOAD RATING: 19 500 N

BEARING STATIC LOAD RATING: 11 300 N

BEARING DYNAMIC EQUIVALENT LOAD: 5 000 N

ROTATION NUMBER: 5 000 min⁻¹

CONTAMINATION DEGREE COEFFICIENT: $a_c = 0.50$

VISCOSITY RATIO: $\kappa = 3.04$

DESIGNATION NUMBER: 6206

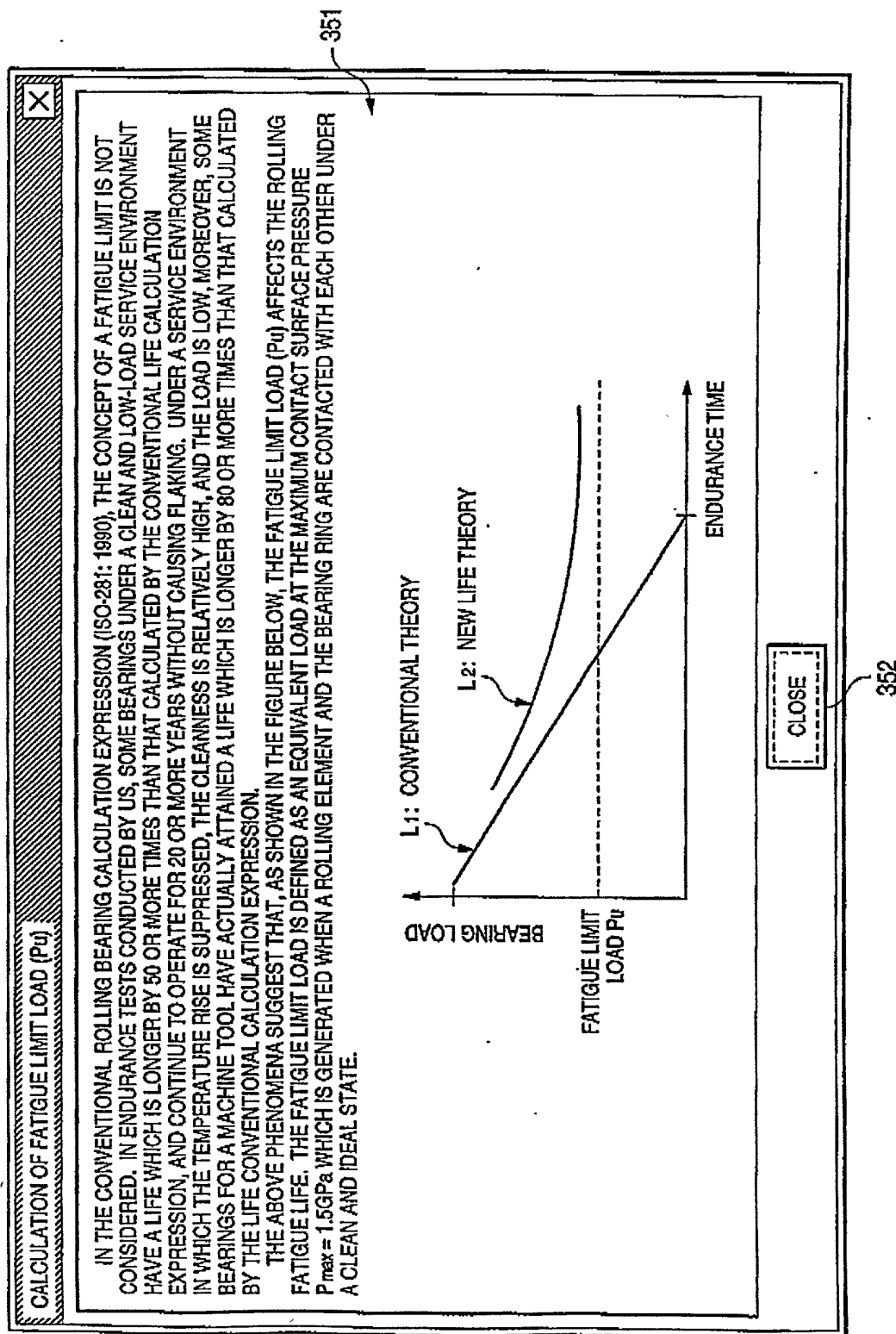
LA (h) calculation:
 $a_1 = 1.00$
 $a_{NSK} = 4.08$
 $L_{10}(h) = 198$
 $LA(h) = 806$

Formula: $LA = a_1 a_{NSK} L_{10}$

Buttons: PRINT, RETURN, MENU

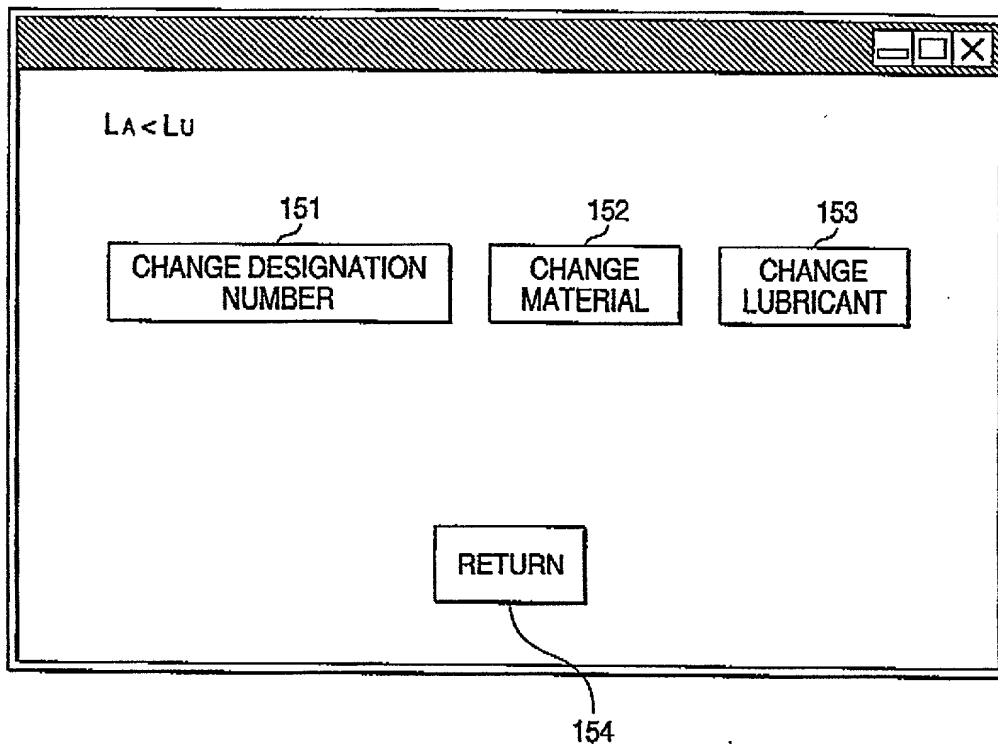
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FIG. 22



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FIG. 23



0940510-08501
T06280-07554660

FIG. 24

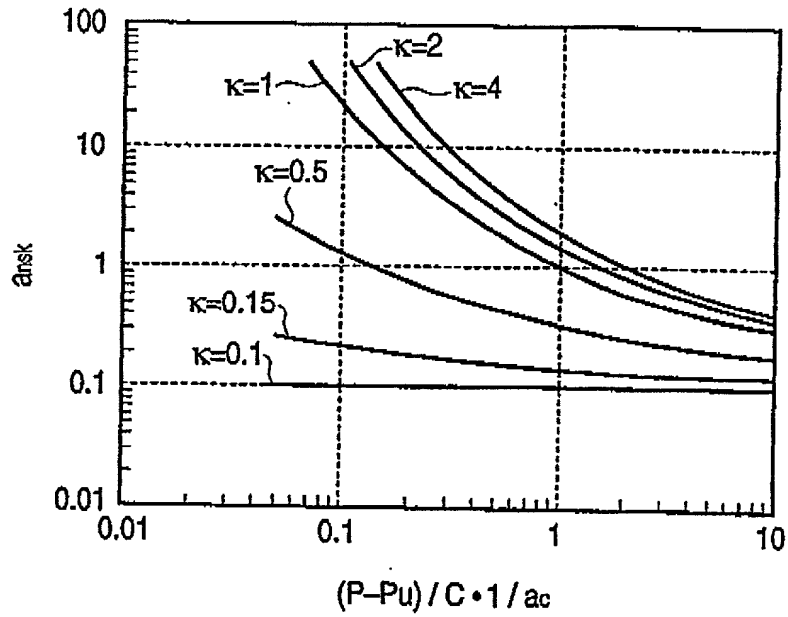


FIG. 25

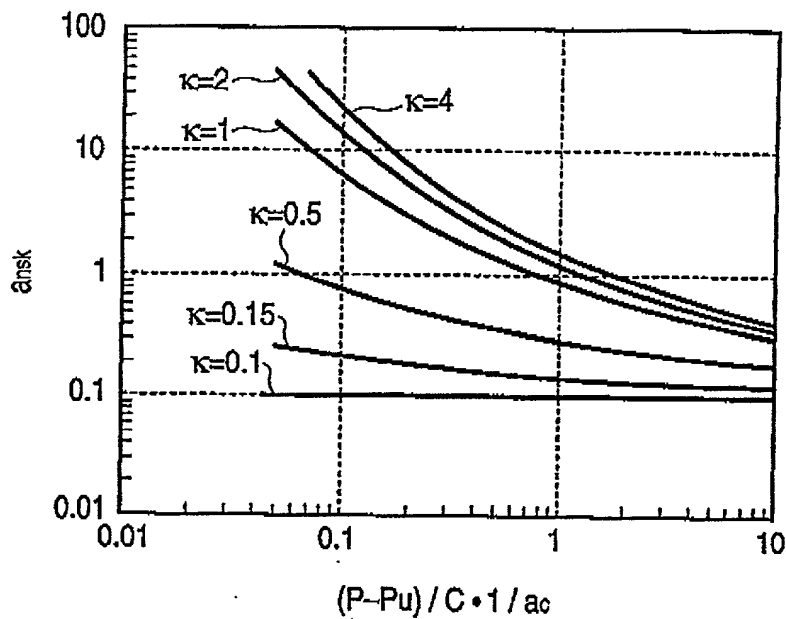
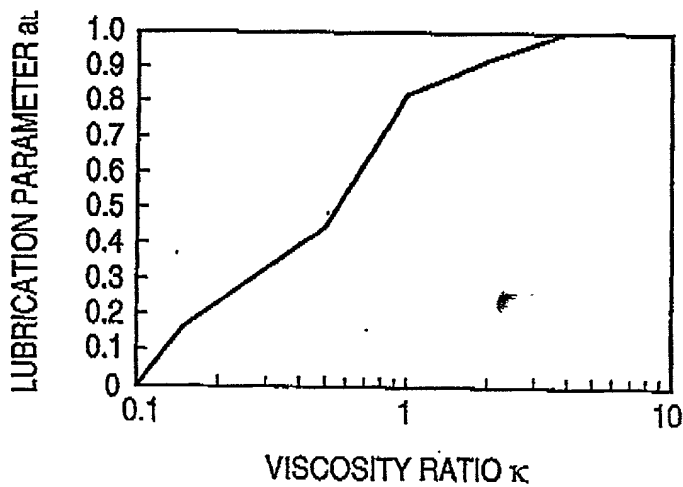


FIG. 26



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FIG. 27

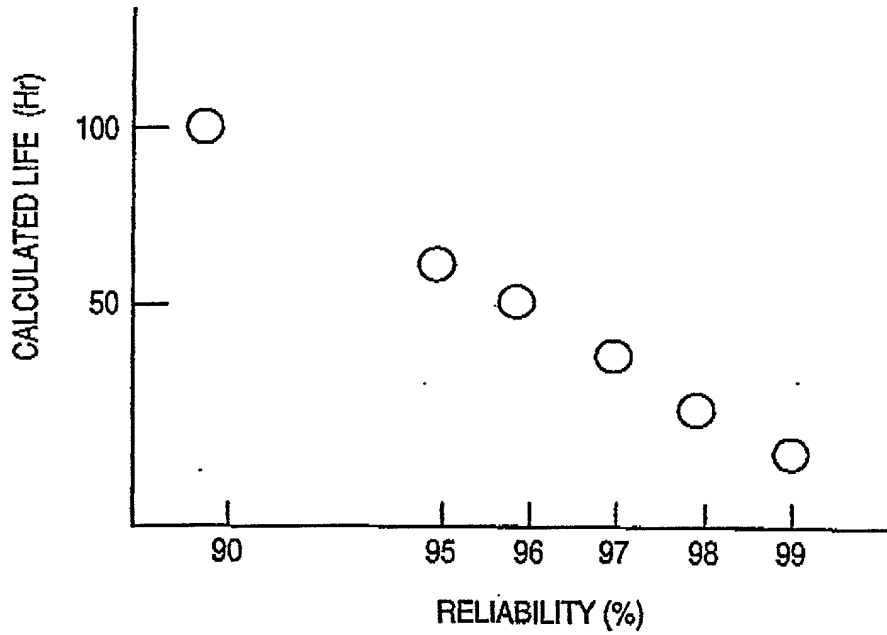
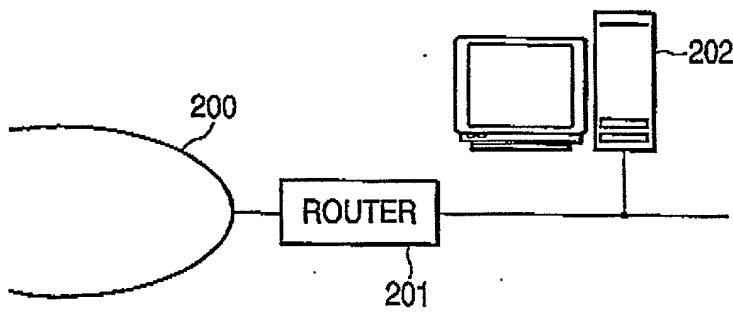
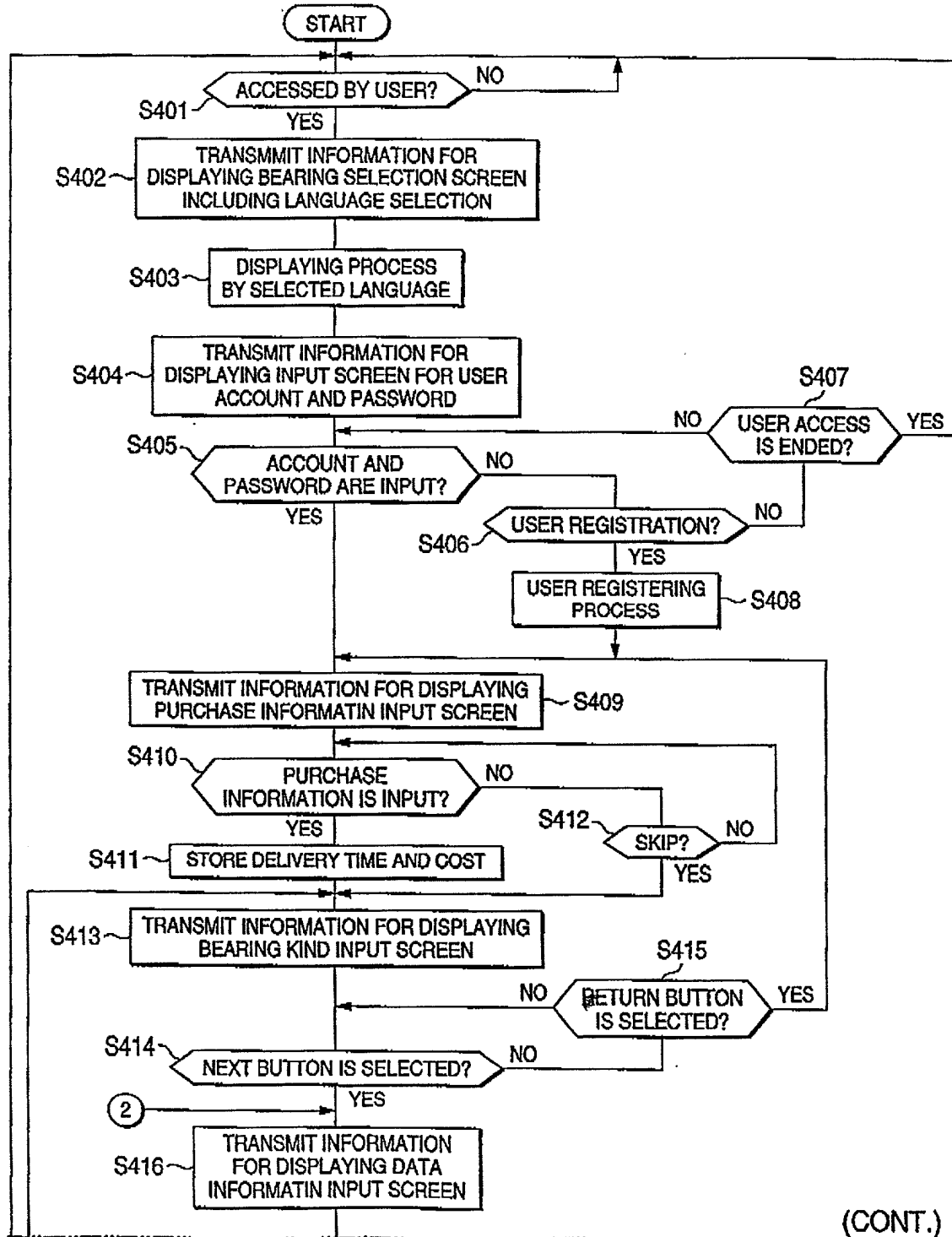


FIG. 28



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FIG. 29



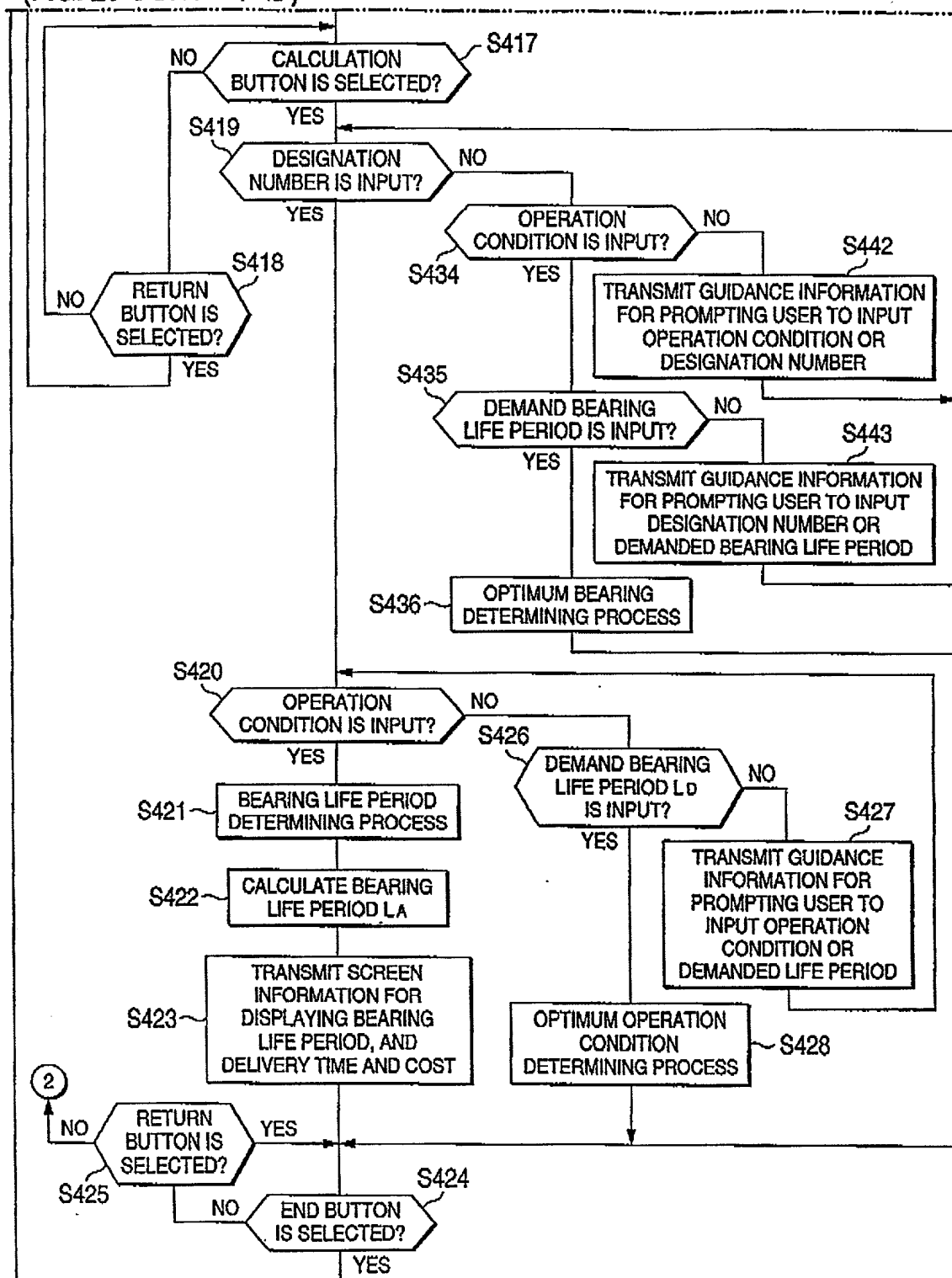


FIG. 30

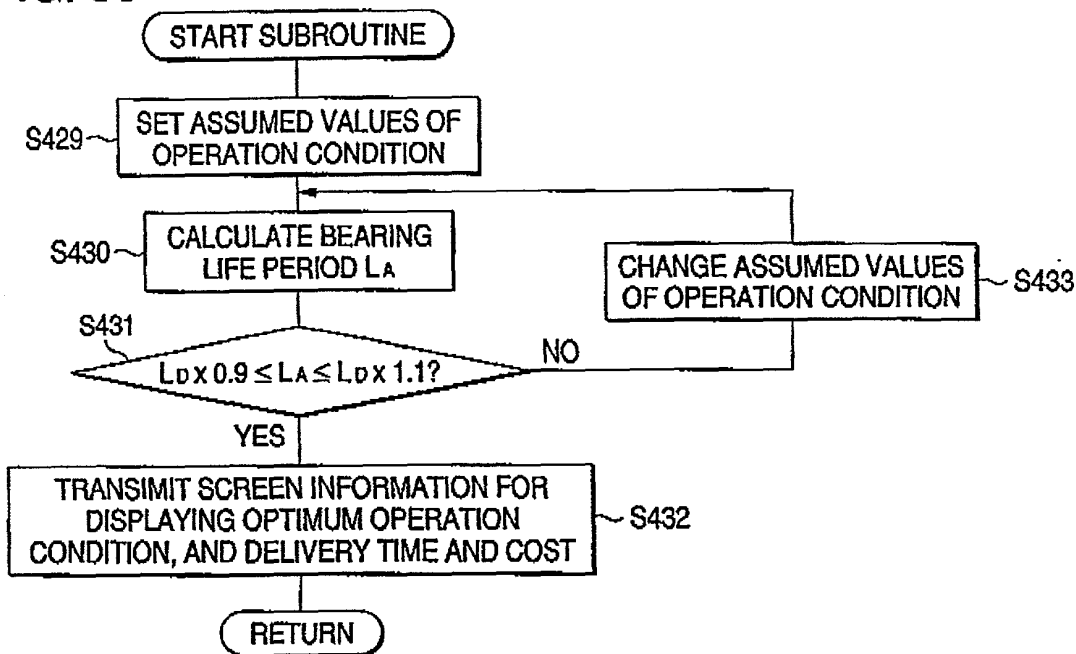


FIG. 31

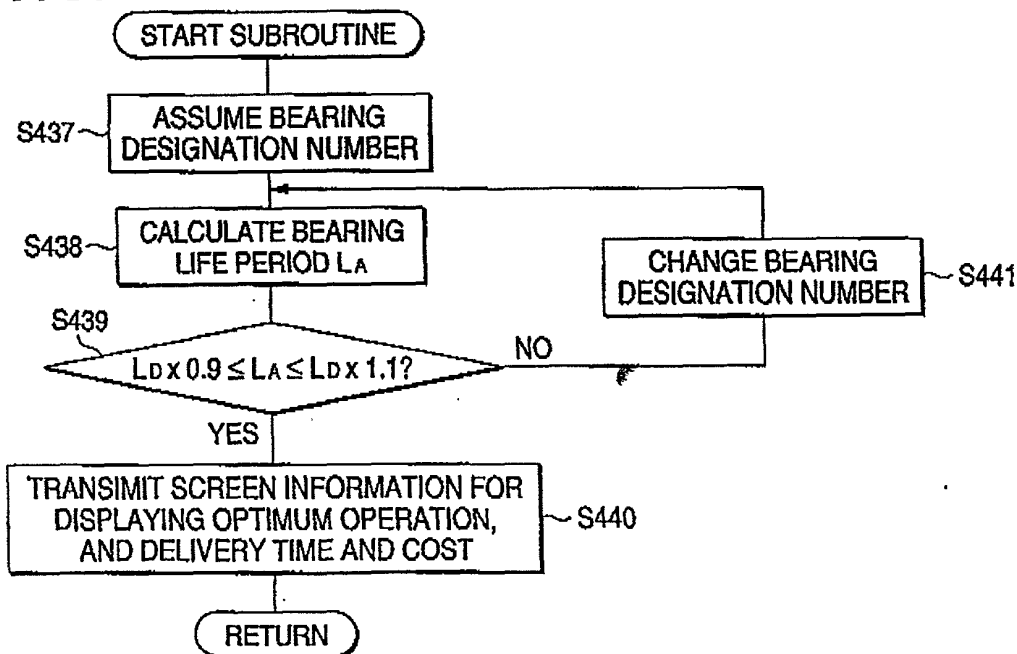


FIG. 30

FIG. 32

BEARING TYPE

211 ☒ BALL BEARING
☐ ROLLER BEARING

☒ RADIAL BEARING
☐ THRUST BEARING 212

COLUMN DESIGNATION: ☒ NECESSARY ☐ UNNECESSARY 213

214 SINGLE COLUMN ▼

215 RETURN 216 NEXT

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FIG. 33

The interface is titled "NEW LIFE CALCULATION EXPRESSION" and includes a "HELP" button. It contains the following input fields and controls:

- BEARING TYPE** (231): A dropdown menu showing "DEEP GROOVE BALL BEARING".
- DESIGNATION NUMBER** (232): A text field containing "6206".
- BEARING DYNAMIC LOAD RATING C (N)** (233): A text field.
- BEARING STATIC LOAD RATING Co (N)** (234): A text field.
- BEARING INNER DIAMETER (mm)** (235): A text field.
- BEARING OUTER DIAMETER (mm)** (236): A text field.
- LOAD P/C ACTING ON BEARING (N)** (237): A text field.
- ROTATION NUMBER (min⁻¹)** (238): A text field.
- OPERATING TEMPERATURE (°C)** (239): A text field.
- OPERATING VISCOSITY ν (mm²/s)** (241): A text field.
- CONTAMINATION DEGREE COEFFICIENT a_c** (242): A dropdown menu showing "ORDINARY ($a_c = 0.5$)".
- LUBRICANT** (240): A dropdown menu.
- SPECIFICATION OF BEARING MATERIAL** (244): A dropdown menu showing "HIGH-CARBON CHROME BEARING STEEL (SUJ2, SUJ3)".
- DEMANDED BEARING LIFE PERIOD Ld** (245): A text field.
- Operating Viscosity ν (mm²/s)** (243): A text field containing "0.5".

At the bottom of the window are four buttons: **CALCULATION** (222), **READ** (223), **SAVE** (224), and **RETURN** (226). There is also an **INITIALIZATION** button (225) located between the "SAVE" and "RETURN" buttons.

FIG. 34 (a)

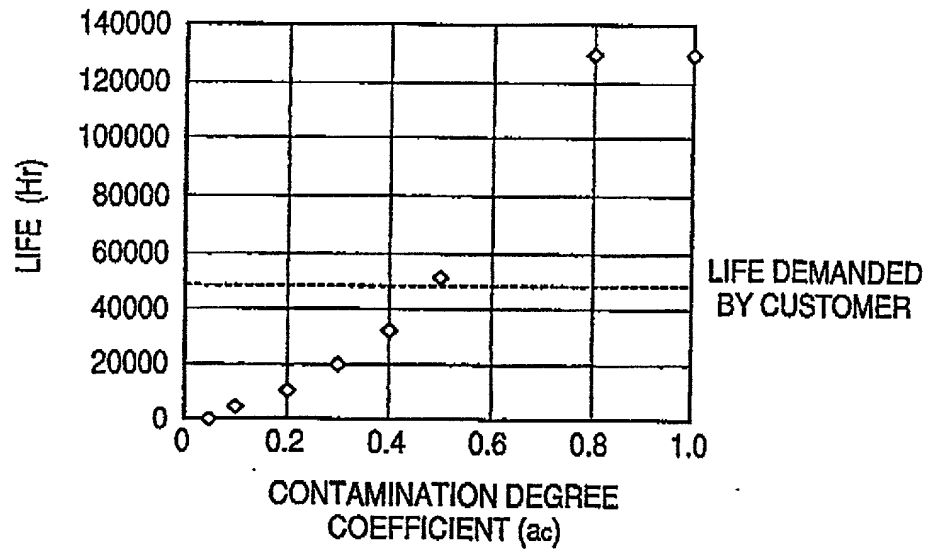


FIG. 34 (b)

